The invention also offers the advantage that it is susceptible of various modifications. Thus, the shape of the markers is not limited to rectangles, and instead other shaped markers may be used. Also the marker display circuits can be modified so as to increase or decrease the length of time the markers are displayed and also to change the vertical positions of the markers on the TV monitor screen. Different forms of imaging devices also may be used. For example, the imaging component of the invention may utilize a BBD semiconductor imaging device rather than a CCD solid state element, as suggested by U.S. Pat. No. 4.488.039. Similarly, the number of lenses in the objective lens unit and also in the zoom lens unit may be changed without affecting operation of the invention.

Other possible modifications and advantages of the invention will be obvious to persons skilled in the art.

What is claimed is:

1. An endoscope apparatus comprising:

a handle assembly;

a tube having a distal end and a proximal end, said tube being mounted within said outer tube and having its proximal end anchored to said handle assembly;

an objective lens unit mounted in the distal end of said tube:

- a shaft having a distal end and a proximal end, said shaft being disposed within and movable along the axis of said tube;
- a solid state imaging device disposed within said tube and attached to said distal end of said shaft so as to be movable therewith along the axis of said tube, said imaging device having an fight receiving surface for receiving an image transmitted by said objective lens unit and being capable of generating an output signal representative of the image transmitted by said objective lens unit;
- a zoom lens unit disposed within said tube between said objective lens unit and said imaging device for transmitting images seen by said objective lens unit to said imaging device, said zoom lens unit being moveable along the axis of said tube relative to said objective lens unit so as to cause the magnification of the image passed by said objective lens unit to be changed in accordance with the axial position of said zoom lens unit in relation to said objective lens unit;

first and second drive means attached to said handle assembly;

- a first motion-transmitting means coupling said first drive means to said shaft, whereby operation of said first drive means will cause axial movement of said imaging device relative to said objective lens unit;
- a second motion-transmitting means coupling said second drive means to said zoom lens unit whereby operation of said second drive means will cause axial movement of said zoom lens unit relative to said objective lens unit and said zoom lens unit;

control means for operating said first and second drive means;

display means responsive to said imaging device output signal for generating a video reproduction of the image passed by said objective lens unit; and

electronic means responsive to said imaging device output signal for causing said display means to generate a video image representative of the position of at least said zoom lens unit or said imaging device.

Apparatus according to claim 1 wherein said electronic means is adapted to cause said display means to generate a

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video image representative of the positions of both said zoom lens unit and said imaging device.

3. Apparatus according to claim 1 wherein said zoom lens unit is movable between a first minimum position and a second maximum position, and said electronic means is adapted to cause said display means to generate a first image representative of said minimum position of said zoom lens unit and a second image representative of said maximum position of said zoom lens unit.

4. Apparatus according to claim 3 wherein said electronic means is adapted to cause said display means to generate an additional image representative of the instantaneous position

of said zoom lens unit.

5. Apparatus according to claim 1 wherein said imaging device is movable between a first minimum position and a second maximum position, and said electronic means is adapted to cause said display means to generate a first image representative of said minimum position of said imaging device and a second image representative of said maximum position of said imaging device.

6. Apparatus according to claim 5 wherein said electronic 20 means is adapted to cause said display means to generate an additional image representative of the instantaneous position

of said imaging device.

7. An endoscope apparatus comprising:

a handle assembly;

an outer tube having a distal end and proximal end, with said proximal end anchored to said handle assembly;

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an inner tube having a distal end and a proximal end. said inner tube being mounted within said outer tube and having its proximal end anchored to said handle assembly:

an objective lens unit mounted in the distal end of said inner tube;

a shaft having a distal end and a proximal end, said shaft being disposed within and movable along the axis of said inner tube;

a solid state imaging device disposed within said inner tube and attached to said distal end of said shaft so as to be movable therewith along the axis of said inner tube, said imaging device having a light-receiving surface from the said image transmitted by said objective lens unit and being capable of generating an output signal representative of the image transmitted by said objective lens unit;

a zoom lens unit disposed within said inner tube between said objective lens unit and said imaging device. said zoom lens unit being moveable along the axis of said inner tube relative to said objective lens unit so as to cause the magnification of the image passed by said objective lens unit to be changed in accordance with the axial position of said zoom lens unit in relation to said objective lens unit;

first and second drive means attached to said handle

a first motion-transmitting means coupling said first drive lens means to said shaft, whereby operation of said first drive means will cause axial movement of said imaging device relative to said objective lens unit;

a second motion-transmitting means coupling said second 60 drive means to said zoom lens unit whereby operation of said second drive means will cause axial movement of said zoom lens unit relative to said objective lens unit and said zoom lens unit;

a space between said outer and inner tubes; light transmitting means in said

space for transmit-

ting light to illuminate an object viewed by said objective lens unit;

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I' means attached to said handle assembly for connecting said proximal end of said light transmitting means to a light source: ]

control means for operating said first and second drive means:

display means responsive to said imaging device output signal for generating a video reproduction of the image passed by said objective lens unit: and

electronic means responsive to said imaging device output signal for

causing said display means to generate a video image representative of the position of at least said zoom lens unit or said imaging device.

8. Apparatus according to claim 7 wherein said objective lens unit and said zoom lens unit have a common optical

9. Apparatus according to claim 7 further including lighttransmitting means disposed in said space between said inner and outer tubes. wherein said light-transmitting means having has a distal end and a proximal end with said distal end termi-

nating at the distal end of said outer tube. 10. Apparatus according to claim 7 wherein said first and second drive means comprise first and second reversible electrical motors respectively.

11. Apparatus according to claim 10 further including user-operable switch means carried by said handle assembly for selectively operating said first and second electrical

12. Apparatus according to claim 7 further comprising means for sensing the extent and direction of movement of said zoom lens unit and said imaging device relative to said objective lens unit and for producing output signals indicative of the extent and direction of said movement, and means for coupling said output signals to said control means for use in controlling the relative positions of said zoom lens unit and said imaging device so that said imaging device is positioned at the focal plane of said zoom lens unit, whereby the image seen by said objective lens and projected by said zoom lens unit is in focus at the image-receiving surface of said imaging device.

13. Apparatus according to claim 7 further comprising first and second means for sensing the extent and direction of movement of said zoom lens unit and said imaging device respectively relative to said objective lens unit and for producing first and second output signals respectively indicative of the extent and direction of movement of said zoom lens unit and said imaging device respectively, and means for coupling said output signals to said control means for use in controlling the relative positions of said zoom lens unit and said imaging device so that at each position of said zoom lens unit said imaging device is positioned at the focal plane of said zoom lens unit, whereby the image seen by said objective lens and projected by said zoom lens unit is in focus at the image-receiving surface of said imaging device.

14. An endoscope apparatus comprising:

an inner tube having a distal end and a proximal end; an outer tube surrounding said inner tube;

- a solid state imaging device mounted within and movable along said inner tube;
- an objective lens unit mounted within and fixed to the distal end of said inner tube;
- a zoom lens unit mounted within and movable along said inner tube; said zoom lens unit being disposed between said objective lens unit and said imaging device;
- a plurality of light-transmitting fibers disposed between said inner and outer tubes, said fibers extending substantially to the distal end of said inner tube so that light transmitted thereby will illuminate the objective field;

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second bidirectional electromechanical means for moving
said imaging device along said inner tube toward or
away from said objective lens unit and said zoom lens
unit, said second electromechanical means comprising
a second reversible electrical motor having an output
shaft and second gear means coupling the output shaft
of said second electrical motor to said imaging device,
whereby energization of said second motor will cause
movement of said imaging device along said inner tube
according to the mode of energization of said second

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a solid state imaging device disposed within said tube and attached to said distal end of said shaft so as to be movable therewith along the axis of said tube, said imaging device having an iffight receiving surface for receiving an image transmitted by said objective lens unit and being capable of generating an output signal representative of the image transmitted by said objective lens unit;

display means responsive to said imaging device output signal for generating a video reproduction of the image passed by said objective lens unit; and

means responsive to said imaging device output signal for causing said display means to generate a video image representative of the position of at least said zoom lens unit or said imaging device.

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